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he remarks that since mathematics is a science having for its aim the study of the exact and necessary relations of magnitude, of the form and position of the objects accessible to our senses, therefore the above-named gentlemen are pursuing not mathematical but metaphysical researches. For them pure mathematics is an exercise in logic; for M. Laurent its object is the study of quantities with the help of numbers. Thirty pages of the work are devoted to the consideration of numbers and thirty-eight pages to that of pan-geometry. He concludes that the plane is an arbitrary surface, or rather that geometry could be taught without defining a plane but by merely calling it an arbitrary surface of which it is impossible to give a precise definition. Geometry is a physical and experimental science,—a language competent to co-ordinate facts, or rather *appearances*, and indifferently Euclidean or non-Euclidean. The Euclidean geometry is that which appeared most simple to the brain of our ancestors. It would not be astonishing if there existed intelligent beings on the planet Mars with a non-Euclidean geometry and with different ideas from ours regarding displacement without change of form.

ESSAYS ON THE THEORY OF NUMBERS. I. Continuity and Irrational Numbers.

II. The Nature and Meaning of Numbers. By *Richard Dedekind*. Authorised Translation by Wooster Woodruff Beman, Professor of Mathematics in the University of Michigan. Chicago: The Open Court Publishing Company. London: Kegan Paul, Trench, Trübner & Co., Ltd. 1901. Pages, 115. Price, 75 cents.

The mathematical reading public unacquainted with German is under considerable obligation to Professor Beman for the present faithful rendering of these two celebrated essays of Dedekind. Modern logical views of continuity and arithmetic are largely based on the results which Dedekind and his contemporary, G. Cantor, furnished (the first of their essays was published in 1872), and it is good that these investigations should be made accessible to all readers in their original form. Furthermore, the German of these essays is not the easiest imaginable reading, and the interpretation of the forms of expression which Professor Beman has given and which has involved considerable study, will also be welcome to readers of German who are in the habit of purchasing but not perusing German books.

"In science," remarks Dedekind, "nothing capable of proof ought to be accepted without proof." But in laying the foundations of the simplest of the sciences, "viz., that part of logic which deals with the theory of numbers," this postulate has not been complied with. In saying that arithmetic (algebra and analysis) is a branch of logic, Dedekind by implication asserts that the number-concept "is entirely independent of the notions or intuitions of space and time . . . an immediate result of the laws of thought." His answer to the question of the nature and meaning of numbers is that "numbers are free creations of the human mind and serve as a means of apprehending more easily and more sharply the difference of things."

He continues in the preface to his essay of 1887: "It is only through the purely logical process of building up the science of numbers and by thus acquiring the continuous number-domain that we are prepared accurately to investigate our notions of space and time by bringing them into relation with this number-domain created in our mind. If we scrutinise closely what is done in counting an aggregate or number of things, we are led to consider the ability of the mind to relate things to things, to let a thing correspond to a thing, or to represent a thing by a thing, an ability without which no thinking is possible. Upon this unique and therefore absolutely indispensable foundation, . . . must, in my judgment, the whole science of numbers be established."

Such is the fundamental idea of Dedekind's thought. He succeeded by means of it in building up a continuous number-system which included not only rational numbers but also, and *necessarily*, irrational numbers. These memoirs can, as their own author remarks, "be understood by any one possessing what is usually called good common sense; no technical philosophic, or mathematical, knowledge is in the least degree required."

- ELEMENTE DER STEREOMETRIE. Von *Prof. Dr. Gustav Holzmüller* in Hagen i. W. Vierter Teil, Fortsetzung der schwierigeren Untersuchungen. Mit 89 Figuren. Leipzig: G. J. Göschen'sche Verlagshandlung. 1902. Pages, xi, 311. Price, bound, 9.50 Marks.
- HÖHERE ANALYSIS. Zweiter Teil. Integralrechnung. Mit 89 Figuren. Von *Dr. Friedrich Junker*, Professor am Realgymnasium und an der Realanstalt in Ulm. Zweite, verbesserte Auflage. Leipzig: G. J. Göschen'sche Verlagshandlung. 1901. Pages, 209. Price, 80 Pf.
- PROJEKTIVE GEOMETRIE. In synthetischer Behandlung. Von *Dr. Karl Doehle-mann*, Privatdozent an der Universität München. Zweite, vermehrte und verbesserte Auflage. Mit 85 Figuren. Leipzig: G. J. Göschen'sche Verlagshandlung. 1901. Pages, 176. Price, 80 Pf.
- DARSTELLEND GEOMETRIE. Erster Teil. Elemente; Ebenflächige Gebilde. Von *Dr. Robert Haussner*, Professor an der Universität Giessen. Leipzig: G. J. Göschen'sche Verlagshandlung. 1902. Pages, 192. Price, 80 Pf.
- REPETITORIUM UND AUFGABENSAMMLUNG ZUR INTEGRALRECHNUNG. Von *Dr. Fr. Junker*, Professor am Realgymnasium und an der Realanstalt in Ulm. Mit 50 Figuren im Text. Leipzig: G. J. Göschen'sche Verlagshandlung. 1902. Pages, 130. Price, 80 Pf.
- REPETITORIUM UND AUFGABENSAMMLUNG ZUR DIFFERENTIALRECHNUNG. Von *Dr. Fr. Junker*, Professor am Realgymnasium und an der Realanstalt in Ulm. Mit 42 Figuren im Text. Leipzig: G. J. Göschen'sche Verlagshandlung. 1902. Pages, 119. Price, 80 Pf.

The domain of pure elementary geometry was immensely extended by the researches of Poncelet, Chasles, Steiner, and Möbius, and the reaction which set in